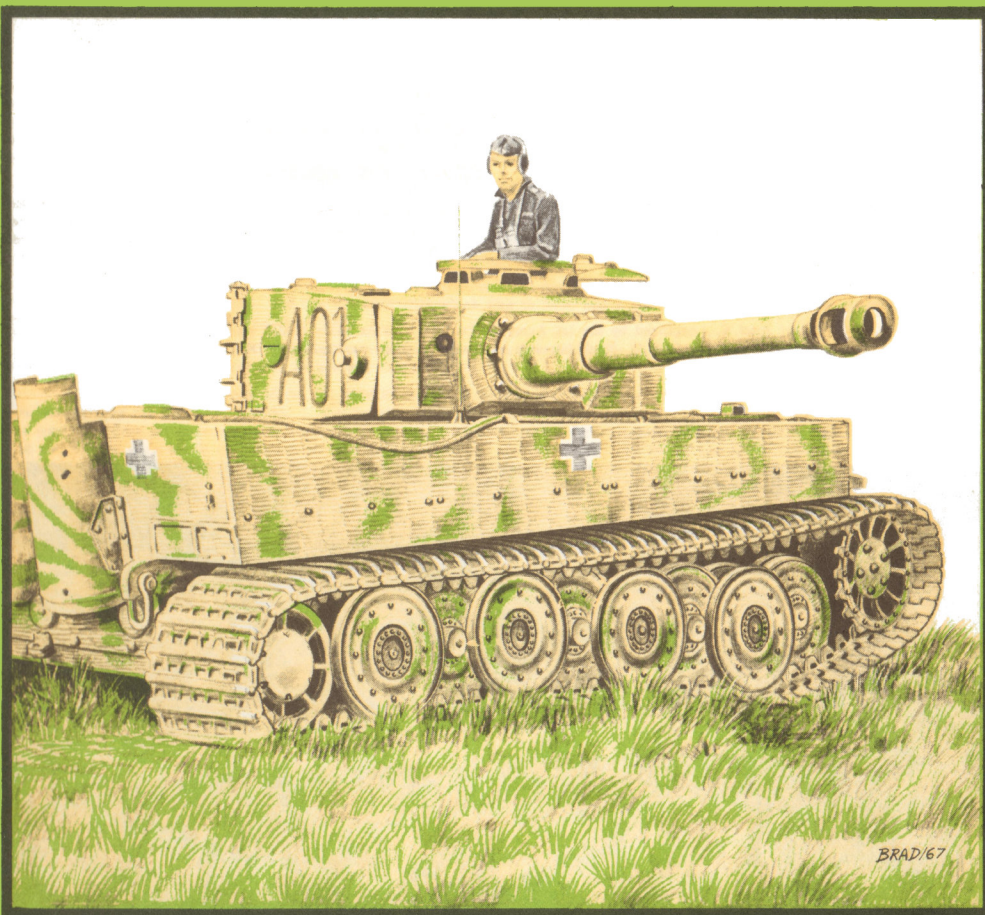




SERIES THIRTEEN

Pz Kpfw 'TIGER' Ausf. E (Double Page) six
view drawing. —(GE)

Medium Tank M4A3E2 (75mm gun, Wet)

Assault, 'JUMBO' —(US)

A 30 'CHALLENGER' Mk. 1 —(UK)



MILITARY VEHICLE PRINTS

Cover Illustration - Drawn by George Bradford

Early examples of the PzKpfw 'Tiger' Ausf. E. series were captured by the Western Allies during the campaigns in Tunisia and Sicily. These examples were extensively examined, photographed and are still on display in Museums in Britain and the United States of America. Only a few of the later improved models appeared in the West and are less familiar to the student of Armour.

In 1944, Waffen SS 'Tiger' Companies were attached to the 2nd Panzer Division for an attack with the objective of splitting the British and American Forces on the Normandy Beachhead. These companies were equipped with the late version, recognisable by the commanders cupola and steel tyred road wheels, of the 'Tiger' Ausf. E., as illustrated on the cover. The colour scheme of sand oversprayed with green is typical of German vehicles of that period. The ribbed effect is caused by the application of a layer of anti-magnetic plaster called 'Zimmerit'. This plaster prevented the attachment of magnetic Anti-tank charges such as used by the Russian tank hunter teams.

The potency of the 'Tiger' was demonstrated, when one of the tanks of the above group, commanded by tank ace Michael Wittman, surprised a column of the 4th County of London Yeomanry and the 1st Rifle Brigade (Units of 7th Armoured Division). The column was completely wiped out and the destruction included at least nine Tanks knocked out. Many of these 'Tigers' were destroyed later in the battle of "Villers Bocage".

BELOW A PzKpfw. 'Tiger' Ausf. E., captured by the 1st Army in Tunisia. This early model was extensively tested in Britain during the War. It is now on display in the R.A.C. Tank Museum at Bovington, Dorset England. Note the drum type cupola and dished rubber tyred road wheels.



BELLONA PRINTS

SERIES 13, No. 49 & 50 (GE)

PANZERKAMPFWAGEN 'TIGER' Ausf. E. 1941 - 44

Development of what eventually became known as the 'Tiger' Ausf. E., was initiated in a discussion with Hitler on 26th May, 1941. Hitler had been impressed by the reports of the armour of the British Matilda and the French tanks, and wanted a heavier tank than the Pz. Kpfw IV to spearhead panzer attacks.

Whilst various medium and heavy tanks had been under development in Germany since 1937, no immediate plans were in hand to supersede or augment the PzKpfw III and IV owing to the satisfaction felt with them. Within a week of the invasion of Russia on 22nd June 1941 the German forces came into contact with the Soviet Medium T.34 and heavy KV.1 tanks. Both Russian tanks outclassed anything the Germans had, either in the field, or under development, and it was this which gave the impetus to implement Hitler's recommendations as quickly as possible.

The demand was for a tank mounting a gun capable of penetrating 100 mm (approx. 4") of armour plate at 1500 meters (1640 yards); this tank, in accordance with current German practise, to have frontal armour capable of withstanding attack by a similar weapon. The gun advocated was an adaption of the highly successful 8.8 cm Flak 36, (Bellona Prints Series 8) but the Ordnance Department were in favour of a smaller calibre weapon of either 6 cm or 7.5 cm provided similar A/P performance could be obtained. By utilising a smaller calibre gun the total size, and therefore the weight, of the projected vehicle could be lower.

Whilst the performance of the 8.8 c.m. Flak 36 was known, the smaller calibre gun still had to be developed. The arguments in favour of a smaller tank were so self-evident however that it was decided to issue two separate specifications. The one given to Henschel designated VK 3601 (VK - Vollkettenkraftfahrzeug - fully tracked motor vehicle) being for a 36/40 ton tank to be armed with the tapered bore weapon O725. The one given to Porsche was for a 45 ton tank to be armed with the 8.8 cm KwK and was designated VK.4501. Separate turrets for both designs were ordered from Krupp.

Because of the shortage of tungsten steel essential for taper bore guns, Hitler ordered their elimination, including the weapon 0725. A total of only seven VK 3601 prototypes were therefore produced, the last of these appearing in April 1942. With the cancellation of the weapon 0725, and in order to enable Henschel to produce a tank with the requisite fire power within the allotted time, it was decided to utilise the turret and gun developed by Krupp under the supervision of Professor Porsche for the VK. 4501 on the VK 3601 as well. A point of interest about this turret is that the sides and rear were formed from a single plate of armour 82 mm (3 1/4") thick bent round into the shape of a horse shoe. Owing to this turret having a ring diameter of 6'-1" (185 cm) against the 5'-5" (165 cm) ring diameter of the VK 3601 Henschel was forced to alter their chassis to accommodate it. This was done by widening the hull above the tracks thus changing the section from a rectangular form to a 'T' shape. Due to these chassis alterations, the heavier gun, and heavier turret, the weight of the vehicle was increased considerably, and the designation was therefore changed to VK. 4501 (H). This new project vehicle had the same main components such as transmission, final drive, and roadwheels as were developed for the VK. 3601.

In order to reduce the ground pressure of this heavier vehicle the track width was increased from 20 1/2" (52 cm) to 28 1/2" (72.5 cm), and a further road wheel was added to each torsion arm for better distribution of the weight on these wider tracks. As the VK. 3601 had already been designed to take advantage of the maximum width permitted for rail transport, some provision had to be made for reducing the overall width of the VK. 4501 (H) when travelling by rail. At one time it was intended to have two individual tracks each side, one of which could be removed, but this idea was dropped in favour of standard 'battle' and narrow 'transportation' tracks.

During development of the VK. 4501 (H) two versions were contemplated. The VK. 4501 (H) which was as built with the Krupp turret mounting the 8.8 cm KwK36, and the VK. 4501 (H2) which was to have had a Rheinmetall designed turret mounting the 7.5 cm KwK 42 (L/70). This second version was never built.

By the middle of 1941 Henschel had made preparations for production of 60 vehicles, and even before a prototype was finished they had increased their preparations to cover a further 1300.

The first prototypes of the VK. 4501 (H) and VK. 4501 (P) underwent their first competitive trials at Rastenburg in front of Hitler on his birthday the 20th April, 1942. The results of these, and subsequent trials were supposed to have shown that the Henschel vehicle was superior, thus production orders were placed for it. The Porsche vehicle, known colloquially within the firm as 'Tiger' now drops out of the picture as a battle tank, although the chassis of the 90 already ordered by Hitler and under construction were eventually adapted as the Panzer Jaeger 'Elefant'. (Bellona Prints, Series 1 No. 4 GE). Results of the various tests carried out on the two VK. 4501 vehicles when compared show very little difference. It was, however, noted by British Intelligence officers after the War, that whilst the Henschel vehicle was almost at the peak of its evolution, the Porsche vehicle had possibly greater scope for further development.

Actual production of the Pz.Kpfw 4501 (H) commenced in August 1942 with twelve units a month. On Hitler's insistence, production was improved, so that by November 1942 the rate had reached 25 units per month. This increase continued and a maximum monthly output of 104 was obtained in April 1944. Production ceased in August 1944 after a total of 1355 had been built including prototypes. Chassis numbers of production vehicles ran from 25000L to 251350 in unbroken sequence. The designation Pz.Kpfw VI was eliminated through Hitler's order of 27th February 1944, the official designation from then on becoming Pz.Kpfw 'Tiger' Ausf. E, which had in fact appeared on official documents prior to this.

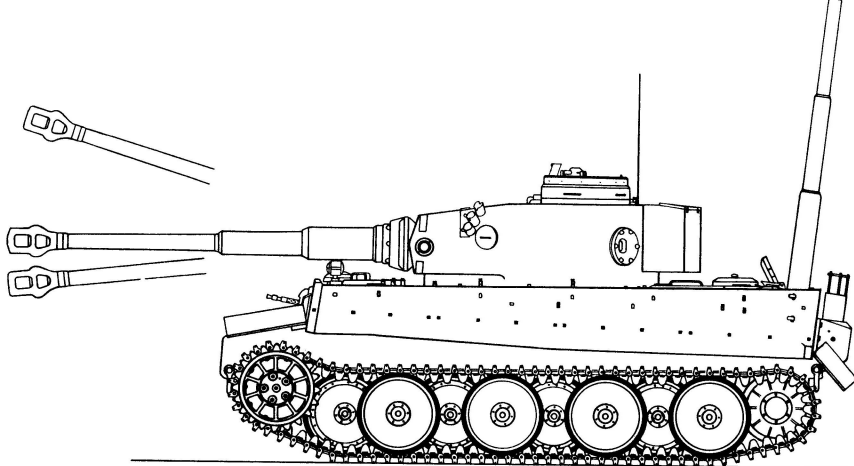
The page consisting of the four view drawings shows a fairly early production model (Chassis No. 250122) fitted with full equipment and battle tracks. As mentioned previously, in order to reduce the width for transportation purposes, the outer wheel of each set of three (shown shaded in the underneath view of the same vehicle) was removed, narrow tracks were fitted, the outer portions of the front and rear mud flaps were hinged upwards, and the side mud guards removed entirely. Normal ground pressure using battle tracks was 14.7 lbs per square inch, but on transportation tracks the ground pressure rose to 20.4 lbs sq".

In view of the size and weight of these vehicles it was envisaged that difficulties would be met in crossing rivers by normal methods, for even in Germany not many bridges were officially capable of carrying their weight. The original specification therefore included equipment to enable them to submerge up to depths of approximately 13 feet (4 metres) and cross on the bed of rivers. There is no evidence to prove that this feature was ever used in action, tank crews being very reluctant to go under water. When one considers that all hatches opened outwards, and that an engine failure would trap the crew with no fresh air being circulated, their fears were justifiable. After 495 vehicles had been built submersing equipment was discontinued, not even all of the 495 had it fitted. For submersion all hatches, ventilators, vision ports, gun mantlet etc., could be sealed relatively simply. A pneumatic tube was inflated to seal the turret ring, and a telescopic snorkel pipe was raised from the rear of the engine compartment. This pipe supplied fresh air, which first passed through the crew compartment, and was then utilised by the engine. Cooling of the engine underwater was by flooding of the radiator compartments after the fans had been disconnected. These fan compartments were positioned both sides of the engine compartment and sealed off from it. Clapper valves were fitted to the exhausts, but back pressure from the engine was relied on to keep water out.

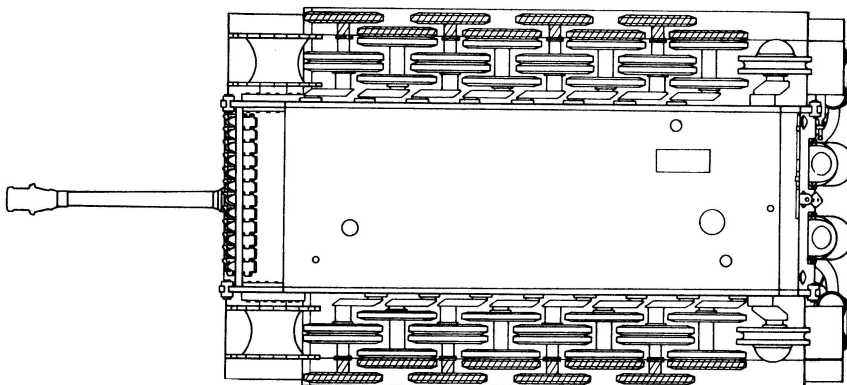
Hitler ordered in July 1942 that the first 'Tiger' Company was to be ready for action by September at the latest. This was against the advice of his Panzer experts and Generals, who wanted it to be thoroughly tested, crews trained, and then used for a massed attack in a Spring offensive in 1943. Following Hitler's orders the first company of 'Tigers' were used in action on the 23rd September 1942 in a secondary operation, in unsuitable tank country consisting of swampy forests near Leningrad. Here they were forced to move in single file along the roads which the Russians had covered with considerable numbers of well concealed heavy anti-tank guns. The results of this was heavy casualties among the 'Invincible' new 'Tigers' and complete loss of secrecy and the surprise that could have been effected the following Spring. Even worse was the fact that due to the weather and terrain the objective of this attack was not even gained despite the cost. The introduction of the 'Tiger' was therefore a repetition in its way of the introduction of the British Mk.I tanks on September 15th 1916. After this debut 'Tigers' appeared in North Africa in April, 1943, Sicily, Italy, and North West Europe, continuing as fighting tanks up to the end of the war. 'Tiger' Battalions were originally organised as independent units under G.H.Q. troops. Later it was decided to include 'Tiger' tanks in the basic organization of German Armoured Divisions, but this never took place except with certain S.S. Panzer Corps.

At the time of its introduction the 'Tiger' Ausf. E. was the most powerful tank anywhere in the world. Workmanship was of a very high order, and the transmission and steering were extremely complicated, requiring many man hours to produce. Some justification for the fully regenerative steering and eight forward ratios in the gearbox, which was fully automatic, was that the vehicle was very light to control. Whilst first class crews were available the 'Tiger' was an efficient tank, but as the standard of training dropped so the mechanical failure rate increased. The main drawbacks, apart from the difficulties of transportation, were a short range of action, due to a fuel consumption of 2 1/2 gals. per mile, and a slow turret traverse. Whilst the turret traverse was normally hydraulic, in case this became inoperative hand traverse wheels were provided for both the Commander and Gunner. A factor which had nothing to do with the design or construction of the 'Tiger', but which tended to hamper its use, was a High Command Order that they were not to be allowed to fall into enemy hands.

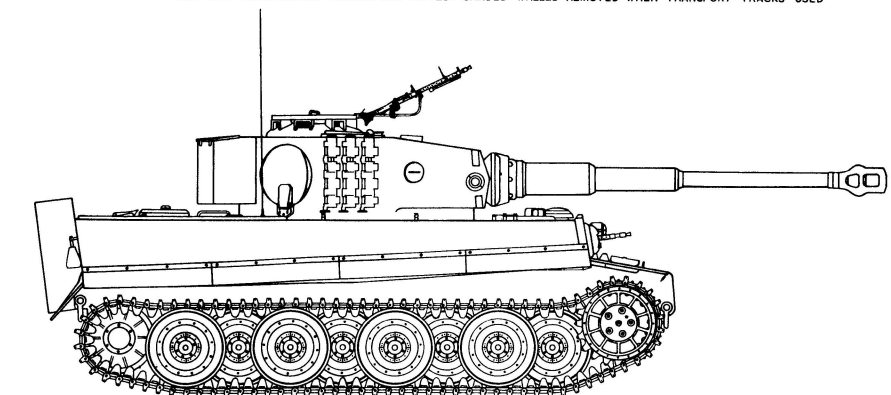
Although the original idea was for an offensive tank, their lack of mobility and the changing strategy of the war led to them being used more and more as a defensive weapon. In this role they were formidable, being used more and more as a defensive weapon. In this role they were formidable, being completely impervious 'Head On' to the British 6pdr., American 75 mm, and Russian 76 mm although the British 6 pdr could effect side penetration at close range. Until the advent of High velocity ammunition for the 6pdr.



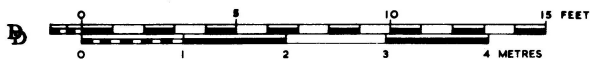
LEFT HAND SIDE TRANSPORTATION TRACKS, SNORKNEL RAISED, AIR PRECLEANERS AND FLASH GUARDS REMOVED.



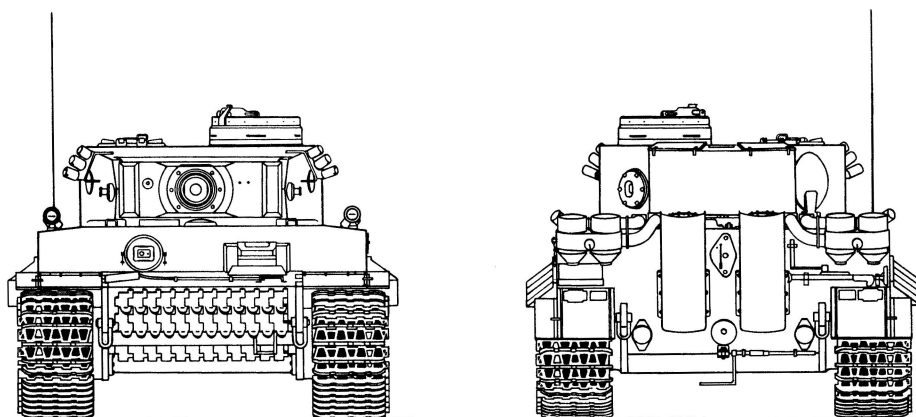
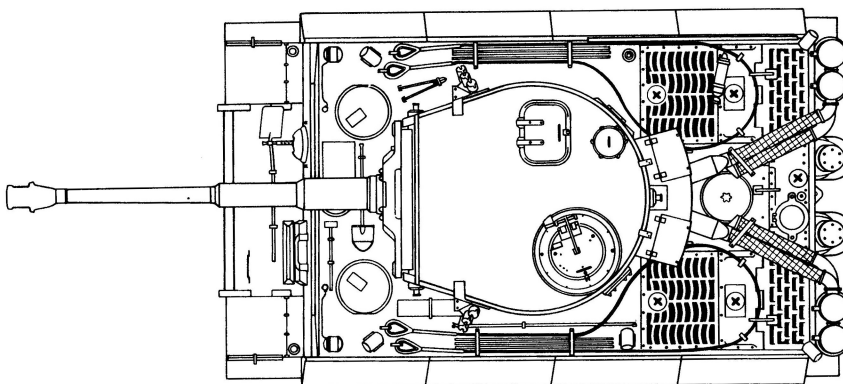
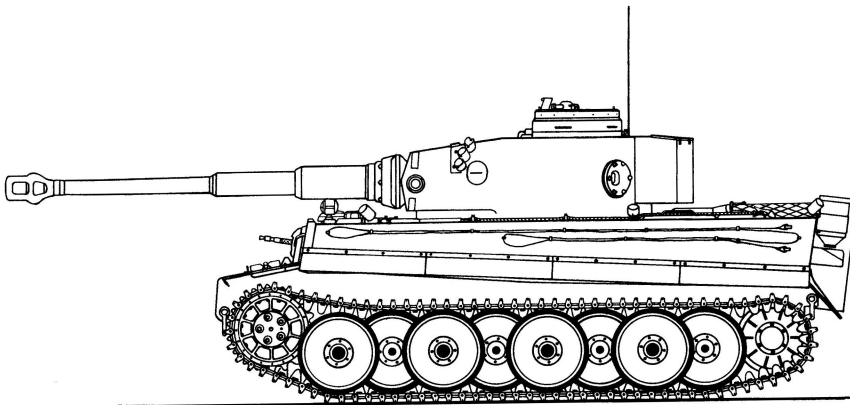
PLAN VIEW FROM BELOW TRACKS NOT FITTED. SHADED WHEELS REMOVED WHEN TRANSPORT TRACKS USED



FINAL VERSION RIGHT HAND SIDE



PANZERKAMPFWAGEN 'TIGER' AUSF. E.
SCALE 1:76 (4m.m. to 1foot) DRAWN BY D.P.DYER.



PANZERKAMPFWAGEN 'TIGER' AUSF. E.
 SCALE 1:76 (4m.m. to 1foot) DRAWN BY D.P.DYER.

PzKpfw. 'Tiger' Ausf. E. (continued)

and the American 76 mm, and the introduction of the Russian 100 mm and 122 mm guns however the Tigers frontal armour was considered shot resistant.

The earliest version of the 'Tiger' did not have an escape hatch in the right hand rear wall of the turret, but had a second pistol port similar to that fitted on the opposite side of all versions. An example of one of these very early models is on display at the Ordnance Museum, Maryland, U.S.A. These early models which appeared at first in Russia were not fitted with air pre-cleaners, which became very necessary during the Russian Summer, and in North Africa.

The five view drawings depict the second stage of development. A point of interest is the five 'S' mine dischargers located on the hull top. These were for close in fighting if infantry support was lacking. When fired, they projected a cannister a short distance into the air, which then exploded scattering a lethal shower of ball bearings. The same type of mine when planted on the ground was nicknamed 'Bouncing Betty' by Allied troops. The next minor modification appears to have been the fitting of a forward facing periscope on the turret roof for the gun loader.

A major modification to the turret next appeared, the drum type cupola with vision slots being replaced by one with seven periscopes, as fitted also to the 'Tiger' Ausf. B. The gun loaders periscope was continued, but the extractor fan was moved to the centre of the turret top and its place taken by the Nahverteidigungswaffe (Bellona Prints Series II) internally loaded, 360° traverse, smoke bomb anti-personnel mine discharger. The fitting of this obviated the need for the externally mounted smoke bomb and 'S' mine dischargers. From the beginning of 1944 the air pre-cleaners mounted on the rear of the vehicle, so called dry filters, system Feifel were discontinued altogether.

In the final version of which a R.H. view only is shown, resilient steel tyred wheels were fitted. These which could carry a greater load consisted of a steel rim fitted outside of and bonded to a rubber tyre. By this means the resilience of rubber, and the wearing properties of steel were utilised to the best advantage. It had also been found that these steel tyres did not permit a layer of ice to build up when travelling through snow, as happened with rubber tyres. This layer of ice having been the main factor in the many examples of broken track that had occurred. Mud tended to pack between interleaved and overlapping road wheels and then freeze in cold weather immobilising the vehicle. For this reason, and also because three road wheels on each axle caused overheating of the wheel bearings, the outside wheels were discontinued altogether on the final version.

It will be noted on the underside view, that in order to allow room for the torsion bars which extended transversely across the hull, one side of the suspension had trailing arms, whereas the other side had leading arms. On other vehicles with torsion bar suspension, the usual practise was to support all wheels on trailing arms, with the wheels on one side being in advance of those on the other side.

The engine used on the 'Tiger' Ausf. E. was a development by Maybach of their range of 12 cylinder Vee engines as fitted to Pz.Kpfw III and IV but of far greater capacity. On the first 250 'Tiger' Ausf. E. they had the same engines as were mounted in the Panther D, differing only in details, mainly to do with the mounting. For the remainder of production these engines were increased in capacity for a larger power output. These improved engines were also fitted to the Tiger B, and the Panther Ausf. A. and G.

Two Command or Befehlswagen versions of the 'Tiger' Ausf. E. appeared designated Sd.Kfz.267, and Sd.Kfz.268. These were similar to standard vehicles except for additional wireless equipment. At least one vehicle was converted to what has been called a Berge Panzer (Armoured Recovery Vehicle). On this the gun was removed, the aperture being blanked off, and a short two position jib mounted centrally on the turret top. This jib could be raised by a cable passing round a pulley mounted at the rear of the turret.

On those vehicles equipped with spare track links early models had them located on the bow plate. When it was realised that there were more vulnerable areas that could be protected, stowage was transferred to the turret sides. For this purpose, pairs of brackets were welded to the turret to support them, three links on the right and five on the left. Eighteen 'Tiger' Ausf. E. returned from the front for overhauling were converted to 'Sturm Tigers' and will be the subject of a later Bellona print.

Technical Specification for Panzerkampfwagen 'Tiger' Ausf. E. Sd Kfz 181.

Crew: 5
Weight, Combat: 125,400 lbs. 56 long tons. 62.7 short tons. 55 tonnes

Performance

Speed, Max. 23 mph (37 Km.ph) Cross Country: 12 mph (19 Km.ph)
Max Gradient: 35 degrees (70%)
Fording depth: 4'-0" (122 cm) or 13'-0" (396 cm)
Trench crossing: 7'-6" (229 cm)
Step: 2'-7" (79 cm)
Ground pressure (Battletracks) 14.7 lbs/sq. ins (1.05 Kg/sq./cm)
Range, Road: 73 Miles (117 Km) Cross country: 42 Miles (67 Km)
Power to weight ratio: (Gross) 11.5 HP/ton, 12.3 Metric HP/ton

Dimensions

Length overall:	27'-9"	(846 cm)
Length:	20'-9"	(632 cm)
Width overall:	12'-3"	(373 cm)
Width for transport:	10'-4"	(315 cm)
Height to top of Cupola:	9'-6"	(290 cm)
Ground clearance:	1'-5"	(43 cm)
Fire height of gun:	6'-1"	(185 cm)
Turret ring dia.:	6'-1"	(185 cm)
Road wheel dia. (overall)	2'-7½"	(80 cm)

Trackwork

Centres:	9'-3"	(282 cm)
Length on ground:	13'-2"	(401 cm)
Width: Battletracks	2'-4½"	(72.5 cm)
Transport tracks	1'-8½"	(52 cm)
Pitch:	5½"	(13.3 cm)
Number of links per track:	95.	Type: dry, single line

Mechanical Details

Engine: 1 x Maybach HL 210 P45 V12. Watercooled Petrol of 21.33 litres developing 642 bhp at 3,000 rpm (First 250 vehicles) or HL 230 P45 of 23.38 litres developing 694 bhp at 3,000 rpm.
Transmissions: Maybach Olvar preselective, 8 forward 4 reverse
Steering: Henschel L600 C Regenerative (2 radii) controlled differential, hydraulic operated.

Suspension: Torsion Bar, 8 Stations per side of 3 or 2 wheels each.
Hydraulic shock absorbers on front and rear axle, housed in hull.

Armament

Main: 1 x 8.8 cm KwK 36
Calibre, and length in calibres: 88 mm (3.46 ins), L/56.
Traverse: 360 degrees. Operation: Two speed, Hydraulic and hand, turret.
Elevation: plus 17 degrees, minus 6.5 degrees.
Secondary armament: 1 x 7.92 mm MG 34 co-axial.
1 x 7.92 mm MG 34 in bow gimbal mount
(Optional on late models, 1 x 7. 92 mm MG 34 on ring of cupola)
1 x 9 mm MP 38 or 40
11 x Smoke bomb launchers (replaced on late model by one Nahverteidigungswaffe)

Stowage

Ammunition, Main Armament: 92 rds. AP and HE
Ammunition, secondary armament: 7.92 mm - 5100 rds in 150 rd belts.
Internal fuel capacity: 125 Imp. gals 141 U.S. gals. 567 Litres

Armour

Type: Rolled homogenous plate interlocking stepped joints welded construction.
Hull: Nose upper: 4.00" (102 mm) at 66 degrees
Nose Lower: 2.44" (62 mm) at 30 degrees
Glass plate: 2.44" (62 mm) at 10 degrees
Divers plate 4.00" (102 mm) at 8 degrees
Sides, Upper: 3.22" (82 mm) at 90 degrees
Lower: 2.44" (62 mm) at 90 degrees
Rear Plates: 3.22" (82 mm) at 82 degrees
Decking: 1.03" (26 mm) at 0 degrees
Belly: 1.03" (26 mm) at 0 degrees

Turret:

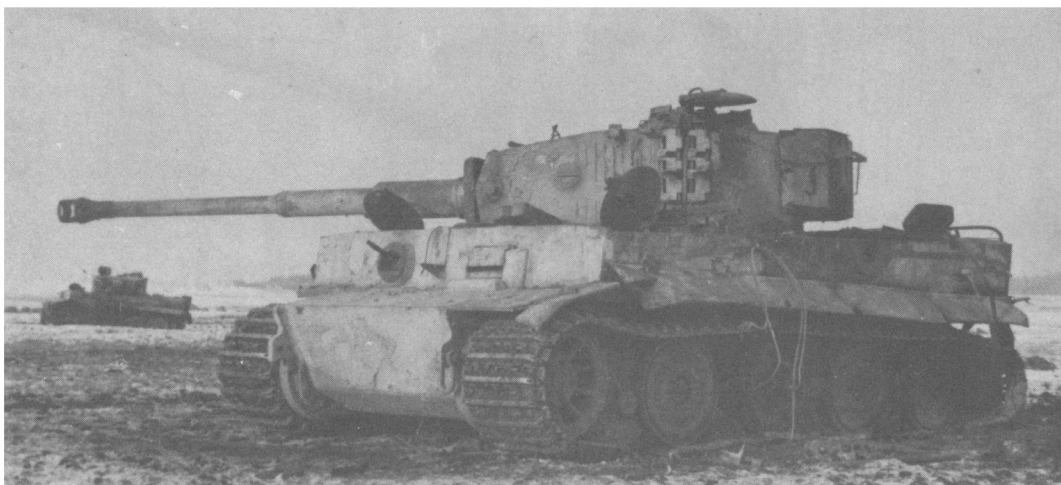
Front: 4.00" (102 mm) at 80 degrees
Turret wall: 3.22" (82 mm) at 90 degrees
Roof: 1.03" (26 mm) at 9 degrees
Mantel 4.33" (110 mm)

Note: German Standard Angles 0 degrees = Horizontal 90 degrees = Vertical



ABOVE This very interesting photograph of the late version of the PzKpfw 'Tiger' Ausf. E. shows the necessity of Transportation tracks Loaded on a rail flat car there is no spare clearance even with the narrow tracks fitted. The removed sections of Mudguard and the Battle tracks can be seen underneath the vehicle. Damage to the front of the side plates indicates that the heavy armour withstood several direct hits. The troops seen examining the tank are members of the Free French Forces.

BELOW Destroyed in combat during the Winter of 1945 this late model PzKpfw. 'Tiger' Ausf. E. represents a tank in full battle order with the wide tracks fitted. It has been whitewashed for camouflage in the snowy conditions evident. The direct hit which destroyed this vehicle appears to have penetrated the side plate, just beneath the turret stowage box.



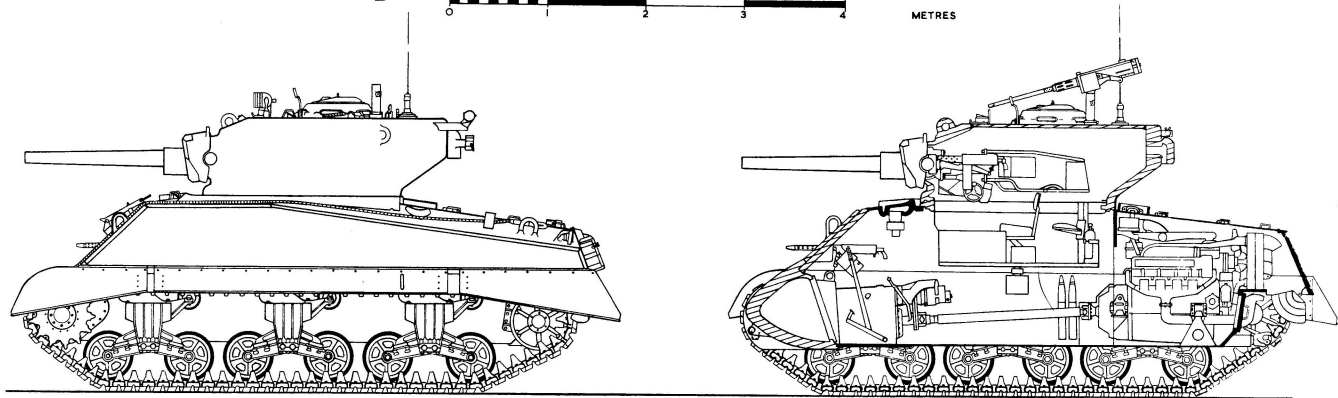
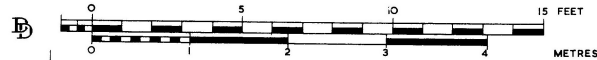
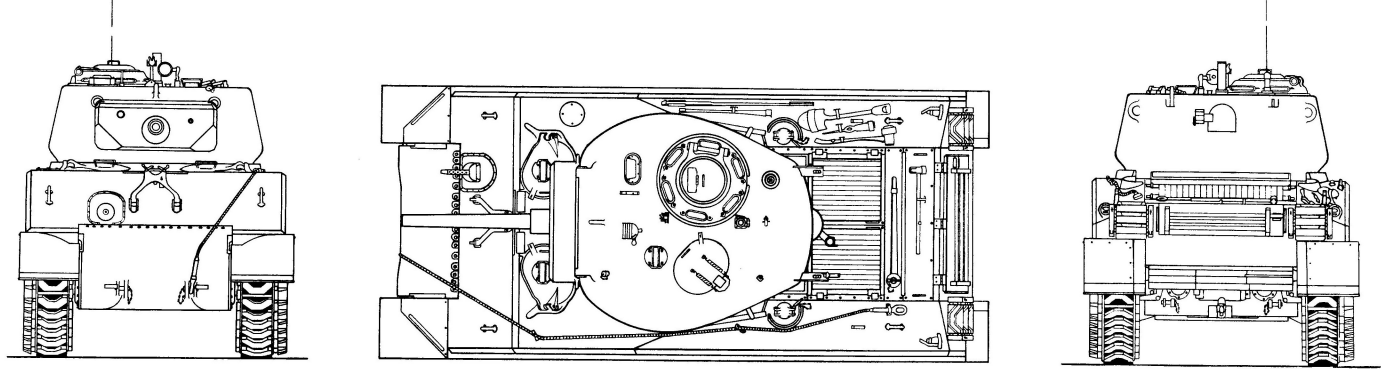


ABOVE An M4A3E2 Assault tank. This version of the Sherman was un-officially known as the 'Jumbo' or 'Cobra King'. The additional armour welded to the front and sides afforded good protection. The unusual gun mantel and 'grouser' extensions to the track plates are the main recognition features of this model of the 'Sherman'.

BELOW A rare photograph of a 'Challenger' in action with 'Cromwell' tanks in North West Europe 1944. Normally one 17pdr, 'Challenger' was issued to each troop equipped with 'Cromwells'.



MEDIUM TANK M4A3E2



MEDIUM TANK, M4A3E2.
SCALE 1:76 (4m.m. to 1foot) DRAWN BY D.P.DYER.

MEDIUM TANK M4A3E2 (75 mm gun, Wet) ASSAULT - 1944

The Grand Blanc Tank Arsenal in America was responsible for the production of the Medium Tank M4A3 75 mm (Wet). During the months of May, June and July 1944, part of the output was switched to the production of a more heavily armoured version of this vehicle. A total of 254 being manufactured.

These uparmoured tanks were to be used as Assault Tanks for co-operation with Infantry following the invasion of occupied Europe which commenced on 10th May 1944.

Whilst still only being armed with the 75 mm gun M3, this was mounted in a new design of turret with a 7" (178 mm) thick gun shield, and 6" (152 mm) thick sides. Photographic evidence suggests however, that some of these tanks had the 75 mm gun replaced by the 76 mm as a field modification at a later date. Whilst there is no documentary proof of this being done, it would have been possible with the more spacious turret, and in view of the fact that the 76 mm had been designed to utilise the 75 mm gun mount.

A cast differential housing with a maximum thickness of 5½" (140 mm) replaced the sharp nosed differential housing that had a maximum thickness of 4½" thick (107 mm) which was being fitted at this period. Additional armour plate 1½" thick was welded to the 47" glacis plate covering it completely and increasing its total thickness to 4" (102 mm). The sides of the hull above the tracks were also completely covered with additional 1½" (38 mm) armour plate thereby increasing the thickness to 3" (76 mm). The hull top, rear, lower sides, and belly remained unaltered.

To give an idea of the value of the increased armour thickness, it was almost impossible to obtain penetration head on by any gun less powerful than the 7.5 cm KwK 40 (as fitted to late PzKpfw IV), and even this had to be firing composite rigid shot at very close range. Due to the extra weight of armour carried, the Combat weight of the vehicle was increased by over six tons. Extended end connectors were therefore fitted to the tracks to reduce the ground pressure on soft terrain. On hard surfaces all the weight was taken on the track blocks themselves giving a ground pressure of approximately 17 lbs per square inch. When the tracks sank into the ground, the so called 'Duck Bill end connectors' increased the effective contact area, thereby reducing the ground pressure to around 141 lbs per square inch which was comparable to the ground pressure of Shermans with 16½" tracks.

Although one type of American 16½" track was interchangeable with other types, it would appear that the T. 48 rubber, non reversible, chevron type were fairly standard for the M4A3E2.

As the vertical volute spring suspension was the same as fitted to standard tanks this was overloaded leading to more maintenance in this direction. Owing to standard engines having to cope with the increased weight, both speed and range were adversely affected. The range was reduced by about a third to 100 miles, and the top speed dropped to 22 mph.

These tanks were only ordered as a limited procurement type, and presumably because of this they never lost their experimental designation E2. The E2 referring to the second experimental model of the M4A3. The first experimental model of the M4A3 having been the M4A3E1 which was used as a test bed for the Spicer model 95 torque converter. The Wet in the designation is to classify the vehicle as having wet ammunition stowage. With this, the bulk of the main armament ammunition is arranged to be stowed in a solution of ethylene glycol in order to reduce the hazard of explosion when the tank was hit.

Stowage on the vehicle drawn is complete, except for a 12' square tarpaulin carried on the rack of the rear, (shown in the closed position) and a 45' square camouflage net carried on top of the rear deck behind the intake grill. The .50 cal machine gun shown on the pintle mount of the sectional view was normally stowed (suitably protected by waterproof covers) in the brackets at the rear of the turret, but has been left out for clarity.

A point of interest was the fact that no headlights, or horn were fitted. As far as can be ascertained the driver had to rely on the spotlight carried on the turret roof for night driving. The vision block cupola and a hatch for the gun loader, together with other turret top fittings were the same as fitted on the turrets of standard Shermans at this period. It will be noted that the ventilator has been situated at the rear on this design.

In action the troops first called them 'Cobra Kings' in reference to the code name for the breakout from the Cherbourg peninsula 'Operation Cobra' which commenced on the 25th July 1944 in which they took their part. However, due to their tubby appearance they were often referred to as 'Jumbos'. In the following months as the Allies advanced they were constantly used as the lead tanks in many actions due to their heavy armour and relative immunity. In December the town of Bastogne, with its American garrison was encircled. A break through the German lines was effected on 26th December to relieve them. This was carried out by a Brigade of the 4th Armoured Division of Patton's third Army, and the first tanks to arrive were M4A3E2.

Technical Specification for M4A3E2 75mm (Wet)

Crew: 5
Weight, Combat: 84,000 lbs. 38 long tons. 42 short tons. 37.4 tonnes.
Performance
Speed, Max Road: 22 mph (35 km.ph)
Cruising: 17 mph (27 km.ph)
Max Gradient: 30° (59%)
Fording Depth: 36" (91 cm)
Trench Crossing: 7'-6"
Step: 2'-0" (61 cm)
Power to Weight Ratio: 11.8 HP/ton (Net) 13 HP/ton (Gross)
Range (Internal Fuel), Road: 100 miles (160 km)
Min. turning Circle: 62' (19 meters)
Dimensions
Length Overall 20'-7" (627 cm)
Width: 9'-3½" (283 cm)
Height to top of handle on cupola: 9'-8" (295 cm)
Ground clearance: 1'-5" (43 cm)
Fire height of gun: 7'-7" (231 cm)
Turret Ring Dia.: 5'-9" (375 cm)
Road Wheel Dia. (overall): 1'-8" (51 cm)
Trackwork
Centres: 8'-11" (210 cm)
Length on ground: 12'-3" (373 cm)
Width: 1'-8" (51 cm) including extended end connectors. Pitch: 6" (15.2 cm)
Number of Links per track: 79
Type: Rubber block double pin
Mechanical details
Engine: 1 x Ford GAA Watercooled V-8 Petrol, developing 500 HP (Gross) at 2,600 rpm. 450 HP (net)
Transmission: Synchronmesh 5 forward, 1 reverse
Steering: Controlled Differential

Suspension: Vertical Volute Spring

Armament

Main: 1 x 75 mm Gun M3 stabilised in elevation
Calibre, and length in calibres: 75 mm (2.95") L/40
Traverse: 360 degrees. Operation: Hydraulic and manual turret.
Secondary armament: 1 x .50 cal Machine gun H.B. m2/A/A
2 x .30 cal Machine guns M.1919A4 bow and coaxial.
1 x 2" Smoke Mortar (fixed, turret)

Stowage

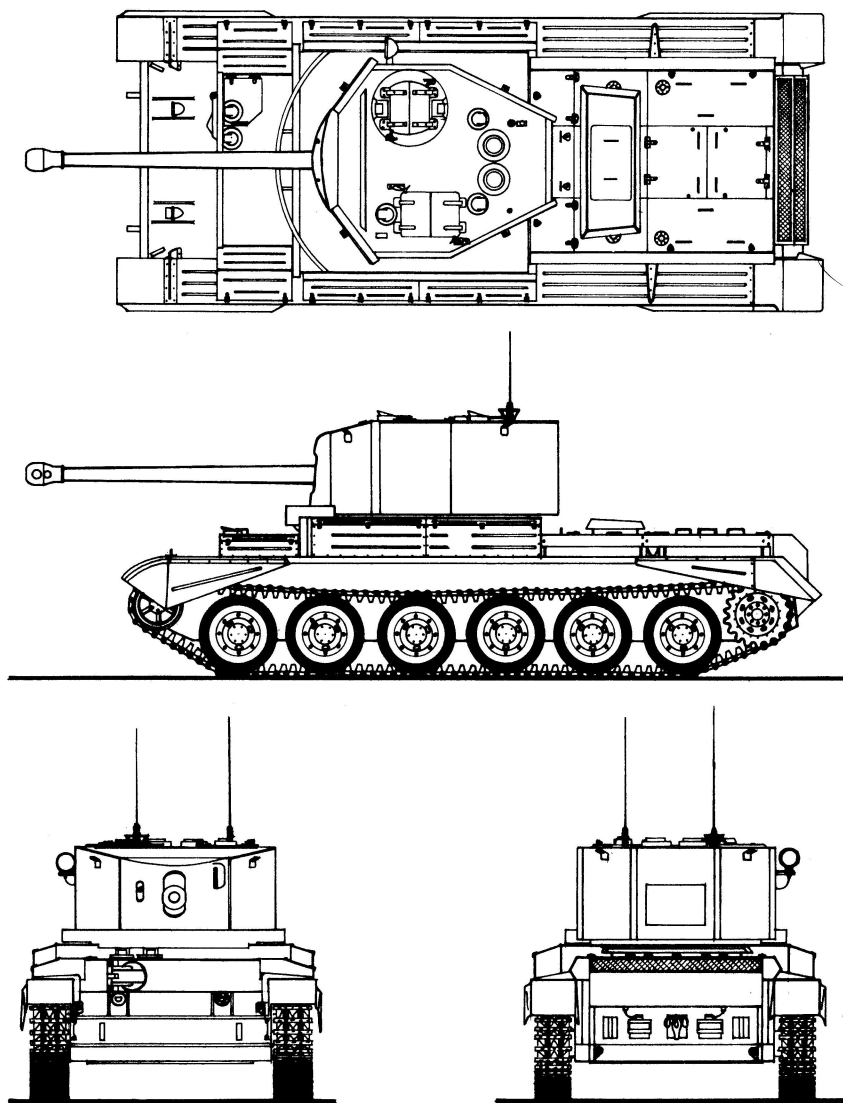
Ammunition, main armament; 75 rds.
Ammunition, secondary armament; 50 cal 6250 rds. .30 cal 6250 rds.
18, 2" smoke bombs, 12 Grenades.

Internal Fuel capacity: 150 Imp. gals. 168 U.S. gals. 762 Litres

Armour

Type: Cast Homogenous steel Differential Housing, Gun Shield, Turret, Front portion of deck, remainder rolled homogenous steel.
Hull:
Nose Lower 5½" (140 cm) to 3" (76 mm) at 0 to 90
Nose Upper 4" (102 cm) at 47° degrees
Sides Lower 1½" (38 cm) at 0 degrees
Upper 3" (76 cm) at 0 degrees
Decking
Front 3" (76 mm) at 0 degrees
Rear 1½" (38 mm) at 70 degrees
Rear Upper 1½" (38 mm) at 22 degrees
Lower 1½" (38 mm) at 10 and 1° (25 mm) at 42
Belly Front 1" (25 mm) at 90 degrees
Rear 1½" (38 mm) at 90 degrees
Turret
Front 3" (76 mm)
Sides 6" (152 mm)
Rear 2½" (63 mm) to 6" (152 mm)
Roof 1" (25 mm) at 90 degrees

Note: U.S. Standard Angles: 0 degrees = Vertical. 90 degrees = Horizontal



TANK, CRUISER, A30, CHALLENGER,
 SCALE 1 : 76 (4m.m. to 1 foot) DRAWN BY A.J.D. NORTH.

A 30 'CHALLENGER' Mk I 1942-44Historical Research by C.O. Ellis

In September 1941, just after the design work on the 17 pdr. Anti-tank gun was initiated it was decided to study the possibility of fitting it in some British tank. Due to the large size it was found that no tank in production had a sufficiently large turret ring, even the latest Cruiser, the A 27M 'Cromwell' (Bellona Prints Series 6, No. 21) had a turret ring of only 57 inches and this was too small.

It was decided, however, to adapt this tank specially for the 17 pdr. Meanwhile, development delays with the 'Cromwell' meant that this vehicle did not go into production until 1943 and in the meantime main emphasis was put on the production of tanks armed with the 6pdr. to replace the existing types armed with only the 2pdr. gun.

The success of the 75 mm gun in the American M3 and M4 in the Desert War and the development of discarding sabot ammunition - hence improved Anti-tank performance for the 6pdr gun. Led the War Office to believe that the use of the two weapons would obviate the need for adopting the 17pdr., as a tank gun with the consequent design problems involved. At the end of 1942 it was finally decided to concentrate on the 75 mm weapon as the standard tank gun but to proceed with 17pdr. armed designs on a long term basis.

Meanwhile the pilot model of the 'Cromwell' with 17 pdr. gun, now known as the A 30 had been completed by the Birmingham Railway Carriage and Wagon Company. The B.R.C. & W. Co. were the parent firm of the development and production of the 'Cromwell'. Stothert and Pitt Ltd. of Bath were at the same time made responsible for the turret design. To accommodate the large turret they produced, it was necessary to lengthen the chassis and widen the fighting compartment above the tracks. To accommodate the increased weight and length it was necessary to reduce slightly the road wheel diameter and add an extra axle.

Any development of 17pdr. armed tanks at this period was strictly secret and even the Select Committee of National Expenditure was not given any information until late in 1942. At this time as a result of its sweeping criticisms, the Committee was informed that a development of the 'Cromwell' mounting the 17pdr. was being tested and showed promise. The results of an official examination of the Pilot model at Lulworth by the Director of Armoured Fighting Vehicles showed that the A 30 was not entirely satisfactory.

Despite the bad features evident it was decided to order 200 A 30's, now renamed 'Challenger', for future use on a small scale in Armoured Divisions. In particular it was felt that it might be needed to counter any new German heavy tanks - The Pz.Kpfw. 'Tiger' Ausf. E. had just made its appearance, thus altering the attitude to use of the 17pdr. It was, however, considered that the 'Challenger' was too lightly armoured to meet a tank of the 'Tiger' class on equal terms and a better protected vehicle was required. At the time the 'Challenger' was the only existing design with a 17pdr. installed and was therefore accepted as a 'stop gap' while something better was being evolved. Vauxhall Motors were asked to adapt the 'Churchill' and the design resulting in the 'Black Prince', work which led to the 'Centurion' Mk I was also put in hand.

Another idea, at first rejected as impossible, was to rearm the 'Sherman' with the 17 pdr. By Summer 1943 successful pilot models of 'Sherman' conversions were ready. The success of this 'Sherman Firefly' (Bellona Prints Series 7, No. 28) another 'stop gap' design, led to the decision in late 1943 to concentrate on this rather than extend the existing 'Challenger' production. Thus existing vehicles available in large numbers could be converted rather than time wasted on producing new second rate types. In this way the 'Firefly' eclipsed the 'Challenger' being the only 17pdr. tank available in quantity for the invasion of Europe in 1944.

The first 200 'Challengers' were produced by 1944 and were numbered in sequence from T 271900 to T 272100. The 'Challenger' took part in fighting in North-West Europe. They were issued mainly to the 'Cromwell' equipped battalions of the Guards Armoured Division and were used on a similar scale of one per troop, as were the 'Firefly's' in 'Sherman' equipped battalions.

Despite its short comings, particularly overall bulk and height the 'Challenger' is interesting as the first British attempt to mount a high velocity gun comparable to existing contemporary Continental weapons, on a fast manoeuvrable chassis. The basic idea was sound and can be regarded as the starting point of the British 'Main battle tank' policy that proved successful in the post war period.

The turret of the pilot model differed from the welded version of the production 'Challenger', it had its armour plate retained by studs similar to those on the turret of the 'Cromwell'. In fact, the turret appears to be identical to that fitted on the experimental T.O.G.II. heavy tank design. The A 30 designation was also used for the Self-propelled gun version of the 'Challenger' known as the 'Avenger'. Drawings show this to be identical to the 'Challenger' but with a much lower partly open topped turret. Photographs of the prototype show it to have return rollers fitted and to appear to be lengthened 'Comet' chassis. This model never progressed beyond the test stage.

Technical Specification for A.30 'Challenger' Mk I.

Crew: 5	Transmission: Merritt Brown, Mechanical, 5 Forward, 2 Reverse.
Weight, Combat: 72, 800 Lbs. 32.5 Long tons. 36 Short tons. 32 Tonnes.	Suspension: Coil springs, Hydraulic shock absorbers.
<u>Performance</u>	<u>Armament</u>
Speed, Max. 32 mph (51 Km.ph)	Main: 1 x 17 pdr. QFSA gun Mk II.
Max. Gradient: 31 degrees (60%)	Calibre, and length in calibres: 72.2 mm (3 ins L/58.4
Fording depth: 3'-5" (104 cm)	Traverse: 360 degrees
Trench crossing: 10'-3" (312 cm)	Elevation: plus 18 degrees, minus 10 degrees
Step: 3'-2" (96.4 cm)	Secondary armament: 1 x .30 calibre Browning, Machine Gun (Co-axial)
Range Road: 150 Miles (241 Km) Cross country: 70 Miles (113 Km)	Internal Fuel capacity: Right hand tank 60, Left hand tank 56 total
Power to weight ratio: 18.5 HP/ton 18.75 Metric HP/ton	116 Imp. Gals. 139 U.S. gals. 527 Litres.
<u>Dimensions</u>	<u>Armour</u>
Length overall, Gun Forward: 26'-3" (800 cm) Gun Aft: 23'-8½" (723 cm)	Type: Rolled Steel, welded
Length: 23'-6" (716 cm)	<u>Hull:</u>
Width overall: 10'-0¾" (307 cm)	Nose upper 2.25" (57 mm) at 17 degrees
Width: 9'-6¾" (291 cm)	Nose lower: 1.00" (25 mm) at 66 degrees
Height: 9'-1¼" (275 cm)	Glasis plate: 1.25" (32 mm) at 73 degrees
Ground Clearance: 1'-4" (40.6 cm)	Drivers plate: 2.50" (64 mm) at 0 degrees
Fire height of gun: 6'-8" (203 cm)	Sides, upper 2.00" (51 mm) at 0 degrees
Turret ring dia.: 5'-6¾" (170 cm)	Lower, double skin: 0.56" (14 mm) and 0.56 (14 mm) at 0 degrees
Road wheel dia. (overall) 2'-7" (78.6 cm)	Rear, upper 1.50" (38 mm) at 0 degrees
	Decking: 0.78" (20 mm) at 90 degrees
	Engine covers: 0.56" (14 mm) at 90 degrees
	Belly: 0.40" (10 mm) at 90 degrees
<u>Trackwork</u>	<u>Turret:</u>
Centres: 8'-1¾" (247 cm)	Front: 2.50" (64 mm) at 0 degrees
Length on ground: 14'-9¼" (450 cm)	Sides: 1.58" (40 mm) at 0 degrees
Width: 1'-3¼" (39.3 cm)	Rear: 1.58" (40 mm) at 0 degrees
Pitch: 4'-33" (11 cm)	Roof: 0.40" (10 mm) at 75 to 90 degrees
Number of links per track: 126 Type: Single pin steel	Mantlet: 4.00" (102 mm)
<u>Mechanical Details</u>	
Engine: 1 x Rolls Royce 'Meteor' V-12 cyl. watercooled, petrol of 27 litres developing 600 bhp. at 2550 rpm.	

Note: British Standard Angles 0 degrees = Vertical, 90 degrees horizontal.